Claims:

1. A marine propulsion system to be driven by a motor, the system comprising:

a propeller having a propeller hub and a plurality of propeller blades mounted on the hub;

a drive for rotating the hub about a first axis;

a propeller blade coupling mechanism for coupling the propeller blades to the hub so the propeller blades can be adjusted in pitch about respective axes transverse to the first axis;

a push member for moving the coupling mechanism to thereby move the propeller blades and therefore adjust the pitch of the propeller blades, the push member having a screw thread;

a nut member having a screw thread and engaging the screw thread of the push member;

a control mechanism for rotating the nut to move the push member because of the engagement of the screw thread on the push member and the screw thread on the nut so the push member is moved to move the coupling mechanism to thereby adjust the pitch of the propeller blades; and

the push member comprises a push rod and a bolt provided about the push rod so the push rod can rotate relative to the bolt, the screw thread of the push member being provided on the bolt, the bolt having a chamber for receiving a thrust portion of the push rod so that upon rotation of the nut in one direction, the bolt is moved in a first direction parallel to the first axis and the push rod is moved with the bolt whilst being able to rotate within the bolt because of the engagement of the thrust portion in the chamber, and upon rotation of the nut member in the opposite direction, the bolt and the push rod are moved in a second direction opposite the first direction parallel to the first axis because of the engagement of the thrust portion of the push rod in the chamber.

2. The system of claim 1 wherein the drive comprises:

a first drive shaft for receiving rotary power from the motor;

a second drive shaft arranged transverse to the first drive shaft;

a first gear on the first drive shaft;

a second gear on the second drive shaft meshing with the first gear so that drive is transmitted from the first drive shaft via the gears to the second drive shaft; and

the propeller hub being connected to the second drive shaft for rotation with the second drive shaft.

3. The system of claim 2 wherein the second drive shaft is hollow and the push rod is arranged in the second drive shaft so that the push rod can rotate with the second drive shaft whilst being moveable in the first and second directions along the first axis.

4. The system of claim 1 wherein the push rod has a retaining member for retaining the bolt for movement in the direction of the first axis, but preventing rotation of the bolt about the first axis.

5. The system of claim 1 wherein the chamber is formed by a flange on the bolt and a cover connected to the flange, the thrust portion of the push rod having a pair of thrust surfaces, and thrust bearing disposed between one of the thrust surfaces and the flange, and the other of the thrust surfaces and the cover.

6. The system of claim 5 wherein the nut member has an open ended recess for accommodating the flange and the cover and for facilitating movement of the push rod relative to the nut member when the nut member is rotated.

7. The system of claim 1 wherein the control mechanism comprises a control shaft, a gear mounted on the control shaft for meshing with a gear on the nut member, and a motor for driving the control shaft.

8. The system of claim 7 wherein the motor is an electric motor for providing precise control over the rotation of the control shaft to in turn precisely rotate the nut and drive the push rod to adjust the pitch of the propellers.

9. The system of claim 1 wherein the coupling mechanism comprises an engaging element for engagement with the push rod, the engaging element having an arm for each of the propeller blades, each arm having a moveable joint member which carries a pin, an eccentric engaged with the pin, a propeller base mounted on the eccentric, the propeller base having a tapered surface and the hub having a corresponding tapered surface for engaging the tapered surface of the base, and whereupon movement of the push rod causes an initial tilting movement of the joint and pin so as to rotate the eccentric to pull the tapered surface of the base away from the tapered surface of the hub to thereby release the propeller blade for pitch adjustment, and continued movement of the push rod continues to move the coupling element and arm so as to rotate the eccentric and the base about the respective transverse axis to thereby adjust the pitch of the propeller blade to an adjusted position, and whereupon when movement of the push rod ceases, the pin and joint are able to return to an equilibrium position so the eccentric returns to its equilibrium position to reengage the tapered surface of the base with the tapered surface of the hub and lock the propeller blade in the adjusted position.

10. The system of claim 9 wherein a biasing element is provided for biasing the base so that the tapered surface of the base is pushed towards the tapered surface of the hub, and whereupon the rotation of the eccentric moves the base against the bias of the biasing element, and upon ceasing of movement of the push rod, the biasing element biases the base so as to return the eccentric and the pin and joint to their equilibrium position and reengage the tapered surface of the base with the tapered surface of the hub.

11. The system of claim 9 wherein the engaging element comprises a claw having a plurality of fingers, each finger being connected to a respective one of the arms.

12. The system of claim 1 wherein the system includes an emergency pitch adjuster for adjusting the pitch of the propeller blades to a predetermined position in the event of breakdown of the control mechanism, the emergency pitch adjuster comprising:

a sprocket gear connected to the control shaft;

a flexible push element for engaging the sprocket wheel so that upon manual depression of the push member, the flexible push element rotates the sprocket gear and therefore the control shaft to in turn rotate the nut member and move the push element to thereby adjust the pitch of the propeller blades, and biasing means for biasing the flexible push element away from the sprocket gear so that the flexible push element can ride over the sprocket gear because of the flexible nature of the push element ready for a further depression to again rotate the sprocket gear and the control member to further adjust the pitch of the propeller blades.

13. A marine propulsion system to be driven by a motor, the system comprising:

a propeller having a propeller hub and a plurality of propeller blades;

a drive for driving the propeller hub about a first axis;

a pitch adjusting mechanism for adjusting the pitch of the propeller blades about respective axes transverse to the first axis;

a control mechanism for controlling the pitch adjustment mechanism;

an emergency pitch adjuster for adjusting the pitch of the propeller blades to a predetermined position in the event of breakdown of the control mechanism, the emergency pitch adjuster comprising:

a rotary member coupled to the control mechanism for rotating the control mechanism;

a moveable abutment member moveable relative to the rotary member;

biasing element for biasing the member away from the rotary member;

whereupon the abutment member is moveable against the bias of the biasing element to engage the gear and rotate the rotary member so that the abutment member can be continually pushed to thereby index the rotary member, and therefore index the control member to in turn index the pitch of the propeller blades to the predetermined pitch so the blades are in a position where drive can be supplied by the propeller blades.

14. The adjuster of claim 13 wherein the rotary member is a sprocket gear having flanges for engagement by the abutment member.

15. The adjuster of claim 13 wherein the drive comprises:

a first drive shaft for receiving rotary power

from the motor;

a second drive shaft arranged transverse to the first drive shaft;

a first gear on the first drive shaft;

a second gear on the second drive shaft meshing with the first gear so that drive is transmitted from the first drive shaft via the gears to the second drive shaft; and

the propeller hub being connected to the second drive shaft for rotation with the second drive shaft.

16. The adjuster of claim 13 wherein a propeller blade coupling mechanism is provided in the hub for coupling the propeller blades to the hub so the propeller blades can be adjusted in pitch about respective axes transverse to the first axis, and the system further includes a push member for moving the coupling mechanism to thereby move the propeller blades, and therefore adjust the pitch of the propeller blades, and wherein the control mechanism is for moving the push member in a linear manner to thereby move the coupling mechanism.

17. The adjuster of claim 16 wherein the push member comprises a push rod and a bolt provided about the push rod so the push rod can rotate relative to the bolt, the screw thread of the push member being provided on the bolt, the bolt having a chamber for receiving a thrust portion of the push rod so that upon rotation of the nut in one direction, the bolt is moved in a first direction parallel to the first axis and the push rod is moved with the bolt whilst being able to rotate within the bolt because of the engagement of the thrust portion in the chamber, and upon rotation of the nut member in the opposite direction, the bolt and the push rod are moved in a second direction opposite the first direction parallel to the first axis because of the engagement of the thrust portion of the push rod in the chamber.

18. The adjuster of claim 17 wherein the second drive shaft is hollow and the push rod is arranged in the second drive shaft so that the push rod can rotate with the second drive shaft whilst being moveable in the first and second directions along the first axis.

19. The adjuster of claim 17 wherein the push rod has a retaining member for retaining the bolt for movement in the direction of the first axis, but preventing rotation of the bolt about the first axis.

20. The adjuster of claim 17 wherein the chamber is formed by a flange on the bolt and a cover connected to the flange, the thrust portion of the push rod having a pair of thrust surfaces, and thrust bearing disposed between one of the thrust surfaces and the flange, and the other of the thrust surfaces and the cover.

21. The adjuster of claim 20 wherein the nut member has an open ended recess for accommodating the flange and the cover and for facilitating movement of the push rod relative to the nut member when the nut member is rotated.

22. The adjuster of claim 13 wherein the control mechanism comprises a control shaft, a gear mounted on the control shaft for meshing with a gear on the nut member, and a motor for driving the control shaft, and wherein the gear coupled to the control mechanism for engagement by the push element is mounted on the control shaft.

23. The adjuster of claim 22 wherein the motor is an electric motor for providing precise control over the rotation of the control shaft to in turn precisely rotate the nut and drive the push rod to adjust the pitch of the propellers.

24. The adjuster of claim 16 wherein the coupling mechanism comprises an engaging element for engagement with the push rod, the engaging element having an arm for each of the propeller blades, each arm having a moveable joint member which carries a pin, an eccentric engaged with the pin, a propeller base mounted on the eccentric, the propeller base having a tapered surface and the hub having a corresponding tapered surface for engaging the tapered surface of the base, and whereupon movement of the push rod causes an initial tilting movement of the joint and pin so as to rotate the eccentric to pull the tapered surface of the base away from the tapered surface of the hub to thereby release the propeller blade for pitch adjustment, and continued movement of the push rod continues to move the coupling element and arm so as to rotate the eccentric and the base about the respective transverse axis to thereby adjust the pitch of the propeller blade to an adjusted position, and whereupon when movement of the push rod ceases, the pin and joint are able to return to an equilibrium position so the eccentric returns to its equilibrium position to reengage the tapered surface of the base with the tapered surface of the hub and lock the propeller blade in the adjusted position.

25. The adjuster of claim 24 wherein a biasing element is provided for biasing the base so that the tapered surface of the base is pushed towards the tapered surface of the hub, and whereupon the rotation of the eccentric moves the base against the bias of the biasing element, and upon ceasing of movement of the push rod, the biasing element biases the base so as to return the eccentric and the pin and joint to their equilibrium position and reengage the tapered surface of the base with the tapered surface of the hub.

26. The adjuster of claim 24 wherein the engaging

element comprises a claw having a plurality of fingers, each finger being connected to a respective one of the arms.

27. A stern drive for a boat and for receiving rotary input power from a motor located in the boat, the stern drive comprising:

a propeller having a propeller hub and a plurality of propeller blades and rotatable about a first axis;

a propeller blade pitch adjusting mechanism for adjusting the pitch of the propeller blades about respective axes transverse to the first axis;

a control shaft coupled to the pitch adjusting mechanism for actuating the pitch adjusting mechanism to adjust the pitch of the propeller blades;

the control shaft having a first gear member;

a second gear member being arranged rearwardly of the first gear member;

a drive element for engaging the first and second gears;

a driver for driving the second gear so that the second gear in turn drives the first gear via the flexible drive element to thereby rotate the control shaft to adjust the pitch of the propeller blades.

28. The stern drive of claim 27 wherein the drive element comprises a flexible drive element.

29. The stern drive of claim 27 wherein the stern leg has a drive for driving the propeller about the first axis.

30. The stern drive of claim 27 wherein the drive comprises:

a first drive shaft for receiving rotary power from the motor;

a second drive shaft arranged transverse to the first drive shaft;

a first gear on the first drive shaft;

a second gear on the second drive shaft meshing with the first gear so that drive is transmitted from the first drive shaft via the gears to the second drive shaft; and

the propeller hub being connected to the second drive shaft for rotation with the second drive shaft.

31. The stern drive of claim 27 wherein the stern drive has a coupling mechanism in the hub for adjusting the pitch of the propeller blades, and a push member for moving the coupling mechanism to thereby cause adjustment of the pitch of the propeller blades, the push member having a screw thread, a nut member having a screw thread and engaging the screw thread of the push member, and the control shaft being coupled to the nut member for rotating the nut member.

32. The stern drive of claim 31 wherein the push member comprises a push rod and a bolt provided about the push rod so the push rod can rotate relative to the bolt, the screw thread of the push member being provided on the bolt, the bolt having a chamber for receiving a thrust portion of the push rod so that upon rotation of the nut in one direction, the bolt is moved in a first direction parallel to the first axis and the push rod is moved with the bolt whilst being able to rotate within the bolt because of the engagement of the thrust portion in the chamber, and upon rotation of the nut member in the opposite direction, the bolt and the push rod are moved in a second direction opposite the first direction parallel to the first axis because of the engagement of the thrust portion of the push rod in the chamber.

33. The stern drive of claim 31 wherein the second

drive shaft is hollow and the push rod is arranged in the second drive shaft so that the push rod can rotate with the second drive shaft whilst being moveable in the first and second directions along the first axis.

34. The stern drive of claim 33 wherein the push rod has a retaining member for retaining the bolt for movement in the direction of the first axis, but preventing rotation of the bolt about the first axis.

35. The stern drive of claim 33 wherein the chamber is formed by a flange on the bolt and a cover connected to the flange, the thrust portion of the push rod having a pair of thrust surfaces, and thrust bearing disposed between one of the thrust surfaces and the flange, and the other of the thrust surfaces and the cover.

36. The stern drive of claim 33 wherein the nut member has an open ended recess for accommodating the flange and the cover and for facilitating movement of the push rod relative to the nut member when the nut member is rotated.

37. The stern drive of claim 33 wherein the driver comprises a motor.

38. The stern drive of claim 37 wherein the motor is an electric motor for providing precise control over the rotation of the control shaft to in turn precisely rotate the nut and drive the push rod to adjust the pitch of the propellers.

39. The stern drive of claim 32 wherein the coupling mechanism comprises an engaging element for engagement with the push rod, the engaging element having an arm for each of the propeller blades, each arm having a moveable joint member which carries a pin, an eccentric engaged

with the pin, a propeller base mounted to the eccentric, the propeller base having a tapered surface and the hub having a corresponding tapered surface for engaging the tapered surface of the base, and whereupon movement of the push rod causes an initial tilting movement of the joint and pin so as to rotate the eccentric about an eccentric axis to pull the tapered surface of the base away from the tapered surface of the hub to thereby release the propeller blade for pitch adjustment, and continued movement of the push rod continues to move the coupling element and arm so as to rotate the eccentric and the base about the respective transverse axis to thereby adjust the pitch of the propeller blade to an adjusted position, and whereupon when movement of the push rod ceases, the pin and joint are able to return to an equilibrium position so the eccentric returns to its equilibrium position to reengage the tapered surface of the base with the tapered surface of the hub and lock the propeller blade in the adjusted position.

40. The stern drive of claim 39 wherein a biasing element is provided for biasing the base so that the tapered surface of the base is pushed towards the tapered surface of the hub, and whereupon the rotation of the eccentric moves the base against the bias of the biasing element, and upon ceasing of movement of the push rod, the biasing element biases the base so as to return the eccentric and the pin and joint to their equilibrium position and reengage the tapered surface of the base with the tapered surface of the hub.

41. The stern drive of claim 40 wherein the engaging element comprises a claw having a plurality of fingers, each finger being connected to a respective one of the arms.

42. The stern drive of claim 27 further comprising an

emergency pitch adjuster for adjusting the pitch of the propeller blades to a predetermined position in the event of breakdown of the control mechanism, the emergency pitch adjuster comprising:

a sprocket gear connected to the control member;

a flexible push element for engaging the sprocket wheel so that upon manual depression of the push member, the flexible push element rotates the sprocket gear and therefore the control member to in turn rotate the nut member and move the push element to thereby adjust the pitch of the propeller blades, and biasing means for biasing the flexible push element away from the sprocket gear so that the flexible push element can ride over the sprocket gear because of the flexible nature of the push member ready for a further depression to again rotate the sprocket gear and the control member to further increase the pitch of the propeller blades.

43. A propeller for a marine propulsion system, comprising:

a propeller hub having a plurality of openings defined by an inclined surface such that each opening increases in size from a radially outermost extremity to a radially innermost extremity;

a propeller blade having a propeller base mounted in each of the openings, each base having an inclined surface which matches the inclined surface of the respective opening;

an unlocking mechanism for moving each base and the propeller blade radially inwardly with respect to the opening to disengage the respective inclined surface of the base from the respective inclined surface of the opening for enabling rotation of the base, and therefore the propeller blade relative to the hub about an axis transverse to a rotation axis of the hub;

a pitch adjusting mechanism for rotating the base to thereby adjust the pitch of the propeller blade; and

a re-locking mechanism for re-engaging the respective inclined surface of the base with the respective inclined surface of the opening to lock the base in the pitch adjusted position.

44. The propeller of claim 43 wherein the unlocking mechanism and the re-locking mechanism comprise a common locking and unlocking mechanism.

45. The propeller of claim 44 wherein the common locking and unlocking mechanism comprise a stem on each base, a respective eccentric coupled to each stem, a respective pin mounted to each eccentric, a push rod for moving the pins to in turn rotate the eccentrics so that the eccentrics push the stems, and therefore the bases, radially inwardly with respect to the hub to unlock the base by radially inward movement of the inclined surface of each base away from the corresponding inclined surface of each opening and after the pitch of the propeller blades have been adjusted, enables radially outward movement of the stems and therefore the bases to re-engage the respective inclined surface of the bases with the respective inclined surfaces of the opening to re-lock the bases and therefore the propeller blades in the pitch adjusted position.

46. The propeller of claim 45 wherein the push rod is coupled to a claw which has a respective arm for each of the propeller blades, each arm being mounted to a respective pin by a socket and eye joint.

47. The propeller of claim 45 wherein biasing elements are provided for biasing the stems and therefore the bases radially outwardly into the position where the tapered surface of the respective bases engage with the tapered surface of the respective openings, and unlocking movement of the bases biases the biasing elements so that

after the propeller blades are moved to a pitch adjusted position, the biasing element biases the stems radially outwardly to re-engage the tapered surface of the respective bases with the tapered surface of the respective openings.

48. The propeller of claim 47 wherein the biasing elements comprise spring washers.

49. The propeller of claim 47 wherein the pin locates in a recess in the base so that after the pin rotates the shaft, the pin engages the base to thereby rotate the base about the transverse axis to adjust the pitch of the propeller blade.

50. The propeller of claim 47 wherein a fixed bridge is located between each base and each eccentric, the bridge having an arcuate slot through which the respective pin passes to accommodate movement of the pin relative to the bridge.

51. A marine propulsion system to be driven by a motor, the system comprising:

a propeller having a propeller hub and a plurality of propeller blades;

a drive for rotating the propeller about a first axis;

a pitch adjusting mechanism for adjusting the pitch of the propeller blades about respective axes transverse to the first axis;

a blade supporting mechanism for supporting the blades in the hub to allow adjustment of the pitch of the blades about the transverse axes, the supporting mechanism comprising:

an engaging element for movement by the adjusting mechanism to adjust the pitch of the blades;

the engaging element having an arm for each of

the blades;
a joint carried by the arm;
a pin mounted in the joint;
an eccentric in engagement with the pin;
a propeller base connected to the eccentric, the propeller base having a tapered surface;
a tapered surface on the hub for engagement with the tapered surface on the base so that when the base is forced radially outwardly with respect to the hub, the tapered surface of the base engages the tapered surface of the hub to lock the propeller in a pitch adjusted position;
a biasing element for biasing the base radially outwardly and the eccentric and pin to an equilibrium position; and
wherein when the adjusting mechanism moves the adjusting element, the engagement between the flexible joint and the pin causes the joint and pin to first rotate the eccentric about an eccentric axis to pull the tapered surface of the base away from the tapered surface of the hub, and whereupon further movement of the adjusting mechanism, and therefore the element, rotates the eccentric and the base relative to the hub about the transverse axis to adjust the pitch of the propeller blades; and
whereupon when movement of the adjusting mechanism ceases and movement of the element ceases, the biasing means biases the base radially outwardly of the hub so that the tapered surface of the base reengages with the tapered surface of the hub to lock the propeller blade in the adjusted position.

52. The system of claim 51 wherein the biasing means also biases the eccentric and pin back to the equilibrium position.

53. The system of claim 51 wherein the joint comprises an outer socket and an inner moveable eye in the socket which carries the pin.

54. The system of claim 51 wherein the eccentric is an eccentric shaft.

55. The system of claim 51 wherein the base includes a stem which engages the eccentric shaft so that rotation of the eccentric shaft about the eccentric axis moves the base relative to the hub in a radial direction so the tapered surface of the base can disengage from the tapered surface of the hub, and continued movement of the arm rotates the eccentric shaft about the respective transverse axis to thereby adjust the pitch of the blade relative to the hub about the respective transverse axis.

56. The system of claim 51 wherein the drive comprises:

a first drive shaft for receiving rotary power from the motor;

a second drive shaft arranged transverse to the first drive shaft;

a first gear on the first drive shaft;

a second gear on the second drive shaft meshing with the first gear so that drive is transmitted from the first drive shaft via the gears to the second drive shaft; and

the propeller hub being connected to the second drive shaft for rotation with the second drive shaft.

57. The system of claim 51 wherein the pitch adjusting mechanism comprises a push member for moving the engaging element to thereby move the propeller blades and adjust the pitch of the propeller blades, the push member having a screw thread, a nut member having a screw thread

and engaging the screw thread of the push member, and a control mechanism for rotating the nut to move the push member because of the engagement of the screw thread of the push member, and the screw thread on the nut, so the push member is moved in a linear manner to move the element to thereby increase the pitch of the propeller blades.

58. The system of claim 57 wherein the push member comprises a push rod and a bolt provided about the push rod so the push rod can rotate relative to the bolt, the screw thread of the push member being provided on the bolt, the bolt having a chamber for receiving a thrust portion of the push rod so that upon rotation of the nut in one direction, the bolt is moved in a first direction parallel to the first axis and the push rod is moved with the bolt whilst being able to rotate within the bolt because of the engagement of the thrust portion in the chamber, and upon rotation of the nut member in the opposite direction, the bolt and the push rod are moved in a second direction opposite the first direction parallel to the first axis because of the engagement of the thrust portion of the push rod in the chamber.

59. The system of claim 56 wherein the second drive shaft is hollow and the push rod is arranged in the second drive shaft so that the push rod can rotate with the second drive shaft whilst being moveable in the first and second directions along the first axis.

60. The system of claim 55 wherein the push rod has a retaining member for retaining the bolt for movement in the direction of the first axis, but preventing rotation of the bolt about the first axis.

61. The system of claim 58 wherein the chamber is formed by a flange on the bolt and a cover connected to

the flange, the thrust portion of the push rod having a pair of thrust surfaces, and thrust bearing disposed between one of the thrust surfaces and the flange, and the other of the thrust surfaces and the cover.

62. The system of claim 58 wherein the nut member has an open ended recess for accommodating the flange and the cover and for facilitating movement of the push rod relative to the nut member when the nut member is rotated.

63. The system of claim 62 wherein a control mechanism is provided for rotating the nut member.

64. The system of claim 63 wherein the control mechanism comprises a control shaft, a gear mounted on the control shaft for meshing with a gear on the nut member, and a motor for driving the control shaft.

65. The system of claim 56 wherein the engaging element comprises a claw having a plurality of fingers, each finger being connected to a respective one of the arms.

66. The system of claim 51 wherein the system includes an emergency pitch adjuster for adjusting the pitch of the propeller blades to a predetermined pitch in the event of breakdown of the control mechanism, the emergency pitch adjuster comprising:

a sprocket gear connected to the control member;

a flexible push element for engaging the sprocket wheel so that upon manual depression of the push element, the flexible push element rotates the sprocket gear and therefore the control member to in turn rotate the nut member and move the push element to thereby adjust the pitch of the propeller blades, and biasing means for biasing the flexible push element away from the sprocket gear so that the flexible push element can ride over the

sprocket gear because of the flexible nature of the push element ready for a further depression to again rotate the sprocket gear and the control member to further increase the pitch of the propeller blades.